TE/EXTC/V (Rev) 1/6/13

PCS

D : PH (April Exam) 307

Con. 7307-13. **GS-9261**

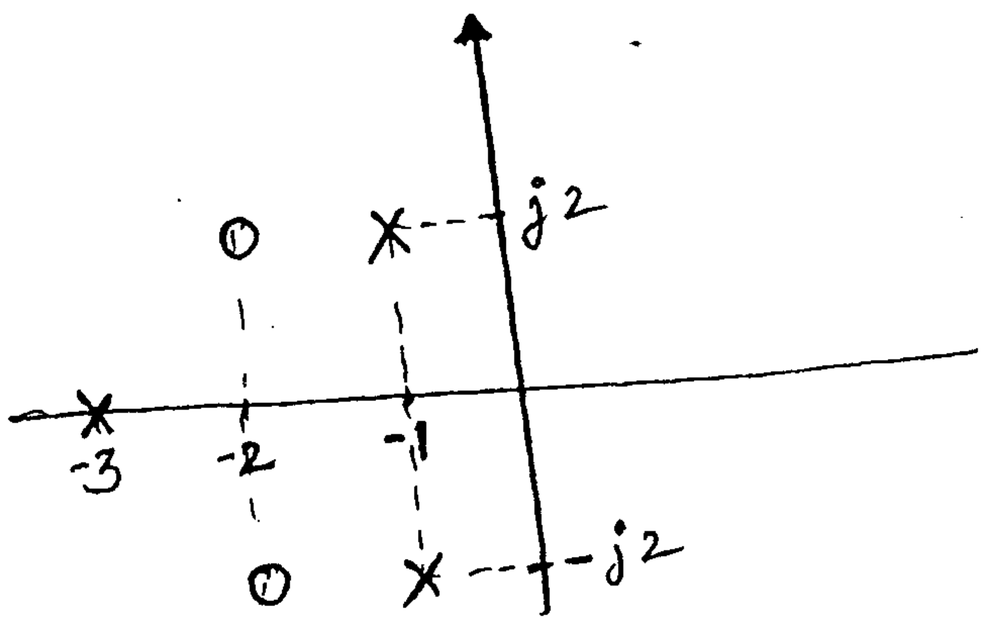
(3 Hours) **[Total Marks : 100**

N.B. (1) Question No. **1** is **compulsory**.
(2) Solve any **four** out of remaining **six** questions
(3) **Figures** to the **right** indicate **full** marks.
(4) Give examples wherever **necessary**.
(5) Mention Question number **correctly.**

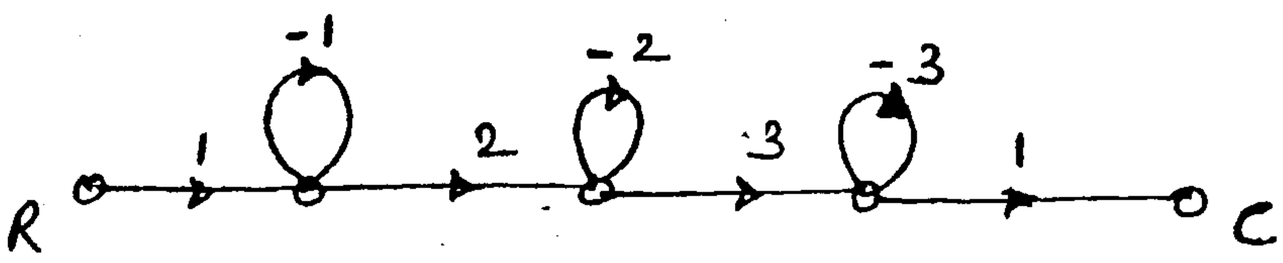
1. (a) What is damping ratio ? Show the location of roots in S-plane for different values of damping ratio. **5**

(b) From the plot-zero plot given below obtain– **5**

(i) Transfer function
(ii) Order of the system
(iii) Characteristic equation.
(iv) DC gain of the system.



(c) Find the transfer function from the signal flow graph given below :– **5**



(d) Define the following terms related to second order system subjected to unit step input : **5**

(i) Rise time
(ii) Peak time
(iii) Peak overshoot
(iv) Delay time
(v) Settling time.

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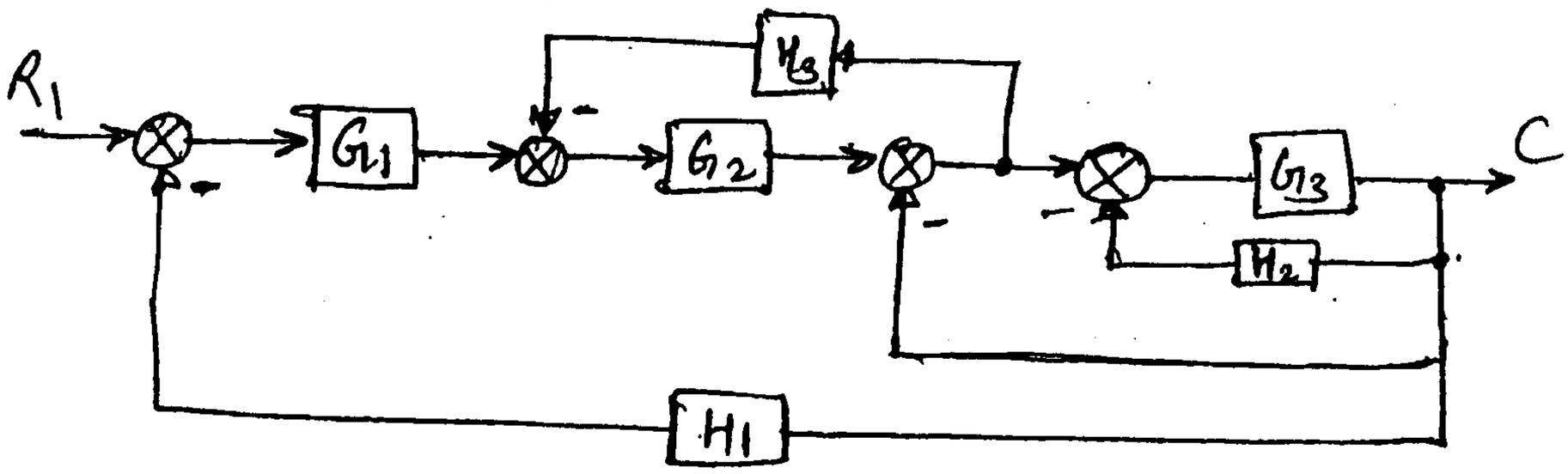
2. (a) Find C using Block diagram Reduction Rules. **10**



(b) Sketch the root locus for a unity feedback control system with **10**

$$G(s)= \frac{K}{s(s+3)\ (s+5)}$$ and determine–

(i) K for Marginal stability.
(ii) Frequency of oscillation for marginal stability.
(iii) K for damping ratio of 0·5.

3. (a) Derive the time response expression for a second order control system subjected to unit step input. **10**

(b) What is a stepper motor ? Mention its types . Explain one type of stepper motor with neat diagrams. **10**

4. (a) Define sensitivity of a control system. Derive the sensitivities S_H^T and S_G^T of a feedback control system where T is the closed loop gain, H is feedback gain and G is the open loop gain of the system. **10**

(b) For the transfer function given below : **10**

$$G(s)\,H(s) = \frac{48(s+10)}{s(s+20)\left(s^2+2-4s+16\right)}$$

Find :

(i) Static position error coefficient·
(ii) Static velocity error coefficient
(iii) Static acceleration error coefficient
(iv) Steady state error if the input to the system is unit step.

5. (a) Sketch the Bode plot for a system with open loop transfer function :– **10**

$$G(s)\,H(s) = \frac{30}{s(1+0\cdot5s)\ (1+0\cdot8s)}$$ and comment on stability.

(b) Find the range of K so that the following systems are stable :– **10**

(i) $s^4 + 7s^3 + 10s^2 + 2Ks + K = 0$
(ii) $s^3 + 3Ks^2 + (K + 2)\,s + 4 = 0$

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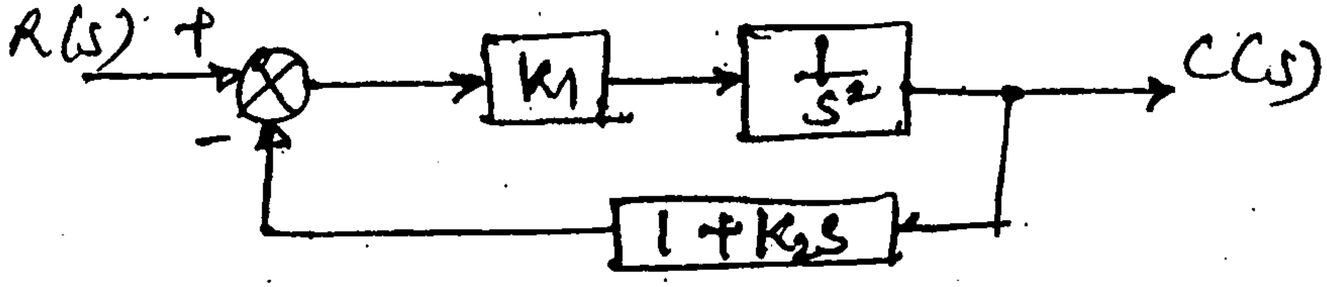
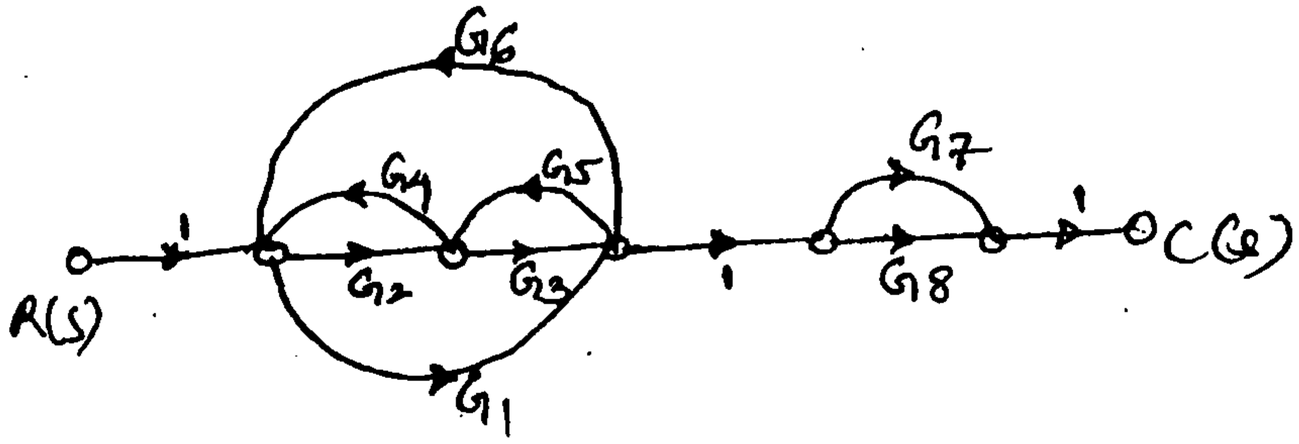
6. (a) For the control system shown below find K_1 and K_2 so that $M_p = 25\%$ and $t_p = 4$ sec. **10**



Also find (i) Settling time

(ii) Rise time

(b) Find the overall transmittance using Masons gain formula. **10**



7. Write short notes on : **20**

(a) Nyquist stability criteria

(b) Error compensation Techniques.

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